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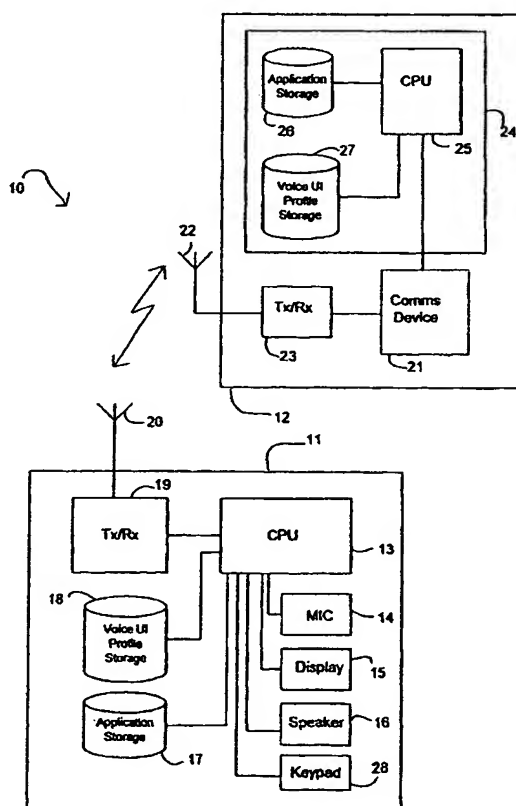
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(54) Title: **MOBILE DEVICE HAVING VOICE USER INTERFACE, AND A METHODE FOR TESTING THE COMPATIBILITY OF AN APPLICATION WITH THE MOBILE DEVICE**



(57) Abstract: A mobile device or MS 11 having voice user interface (UI) as part of its multimodal input/output capabilities is provided with a storage area 18 for storing a profile indicating the voice UI capabilities. The profile indicates the automatic speech recognition, text-to-speech, vocabulary and grammar capabilities, amongst others. An application, such as a diary program or one allowing entry into a lotto, is initialised on the MS 11 with reference to the profile. When the application is run, the profile is referred to such that parts of the application which are appropriate to the profile are run whilst those which are inappropriate to the profile are not run. Alternatively, the application may be run on a voice UI application server 24 forming part of a base station 12. An emulator (Figure 4) for testing an application using a profile of a target device is also disclosed.

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Mobile device having voice user interface, and a method for testing the compatibility of an application with the mobile device

Mobile Devices

Field of the invention

This invention relates to a method of operating a mobile device, to a mobile device,
5 to a system, to a method of and to apparatus for testing the compatibility of an application with a mobile device.

Background art

A current trend with mobile devices, and in particular mobile telephones and
10 personal digital assistants (PDAs), is to provide them with multimodal interaction capabilities. Following this trend, it is anticipated by the inventors that some new devices will soon be provided with voice user interface capabilities. Such capabilities are expected to include text-to-speech (TTS) synthesis, which would allow a terminal to 'speak' text stored in a memory within itself or received over a
15 communications channel and/or to play pre-recorded wave files, and automatic speech recognition (ASR), which would allow a terminal to understand instructions and information spoken by a user. However, such features would require considerable processing resources, and possibly also relatively large databases, which would present problems for developers of applications having voice user
20 interface features.

Summary of the invention

According to one aspect of the invention, there is provided a method of operating a mobile device, the method comprising: maintaining a profile of voice user interface
25 capabilities associated with the device; storing an application having voice user interface features on the device or on a server in communication with the device; examining at least part of the profile; and using voice user interface features of the application which are appropriate to the profile and refraining from using inappropriate features.

30

The using step typically effects control of a speaker and/or a microphone.

According to a second aspect of the invention, there is provided a mobile device, comprising: a storage device for maintaining a profile of voice user interface capabilities associated with the device; a reader for examining at least part of the profile; and an application runner arranged to run an application using voice user interface features of the application which are appropriate to the profile and to refrain from using inappropriate features.

According to a third aspect of the invention, there is provided a system comprising: a mobile device having voice user interface capabilities; and a server, capable of communicating with the mobile device, the server being arranged to examine at least part of a profile voice user interface capabilities associated with the mobile device, and to run an application using voice user interface features of the application which are appropriate to the profile and to refrain from using inappropriate features.

According to a fourth aspect of the invention, there is provided a method of testing the compatibility of an application with a mobile device, the method comprising: maintaining a profile of voice user interface capabilities associated with the device; controlling an emulator to emulate the voice user interface features of the device using at least part of the profile; and running the application on the emulator.

According to a fifth aspect of the invention, there is provided apparatus for testing the compatibility of an application with a mobile device, the apparatus comprising: a reader for reading at least part of a profile of voice user interface capabilities associated with the device; and an emulator for emulating the voice user interface features of the device using the at least part of the profile, and for running the application.

Running the application typically effects control of a speaker and/or a microphone.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings.

Brief description of the drawings

In the drawings,

Figure 1 is a schematic diagram of a system including a mobile station and a base station, according to certain aspects of the invention;

5 Figure 2 is a flow chart illustrating operation of the mobile station of Figure 2;

Figure 3 is a flow diagram illustrating operation of the Figure 1 system;

Figure 4 is a schematic diagram of emulator apparatus according to certain aspects of the invention; and

Figure 5 is a flow chart illustrating operation of the emulator apparatus of Figure 4.

10

Detailed description of the preferred embodiments

Referring firstly to Figure 1, a system 10 is shown comprising a mobile station (MS) 11 and a base station (BS) 12, both of which are configured to operate as part of the universal mobile telephone system (UTMS). The MS 11 may be a mobile telephone handset, a personal digital assistant (PDA) or any other suitable device. The MS 11 is provided with multimodal input/output capabilities. The MS 11 includes a central processing unit (CPU) 13, which is connected via respective connections to each of a microphone 14, a display 15, a speaker 16, a keypad or keyboard 28, an application storage device 17, a voice user interface (UI) profile storage device 18 and a transceiver 19. An antenna 20 is connected, via the transceiver 19, to the CPU 13, thereby allowing it to communicate with devices external to the MS 11. The storage devices 17 and 18 may take any convenient form, such as RAM, EEPROM, magnetic storage etc., and may be constituted by the same physical storage device. The MS 11 also includes other features typical of its type, but these are not shown for the sake of clarity.

25

The BS 12 comprises a communications device 21, which includes all of the standard processing hardware and software found in a conventional BS, and which is connected to an antenna 22 via a transceiver 23, and to voice UI application server 24. Included in the voice UI application server 24 is a CPU 25, which is connected to each of an application storage device 26 and a voice UI profile storage device 27 also forming part of the server. It is the CPU 25 of the voice UI application server 24 which is connected to the communications device 21, to allow

30

communication therebetween. As is usual, the BS12 is also connected to communicate with a large network, such as the Internet or PSTN.

The BS 12 is capable of communicating with the MS 11 using signals according to the UMTS standard, although any other communications protocol, such as GSM, Bluetooth, PSN or any of the Japanese, Canadian or US standards, etc., may be used instead.

An example of a voice UI profile associated with the MS 11, and stored in the voice UI profile storage device 18, will now be provided. The voice UI profile is divided into a number of sections including but not limited to a general section, a speech recognition section, a speech synthesis section, an input section, an output section, and a dialogue section. In this example, the general section includes amongst other information the following:

15

```
device.complexity = BIG_TERMINAL
device.profile_last_modified = 04.07.2002
```

from which it can be deduced that the MS 11 has voice UI capabilities in the class 'big terminal' and that the profile was last modified on 4 July 2002. In the speech recognition section, the voice UI capabilities of the MS 11 relating to automatic speech recognition (ASR) are identified thus:

25

```
asr.lang_1 = UK_english
asr.lang_2 = finnish
asr.grammar.lang_1 = bigram1
asr.grammar.lang_2 = stochastic_grammar
asr.max_words = 500
asr.natural_language_understanding = no
asr.multilingual = no
asr.barge_in = no
asr.vocab.lang_1 = english_vocab
asr.vocab.lang_2 = finnish_vocab
```

30

From this, it can be deduced that the MS 11 has UK English language capabilities with a grammar file named as bigram 1 and Finnish language capabilities with a language model stored in a file named stochastic grammar, that it has a vocabulary of each of the languages UK English and Finnish; that it has no natural language, multilingual or barge-in capabilities; and that it is able to handle a maximum of 500 words of vocabulary at a time.

The MS 11 has text-to-speech (TTS) capabilities of a formant synthesis type in UK English and in Finnish, and this information is given by the following information, which forms a speech synthesis section:

```
tts.lang_1 = UK_English
tts.lang_2= finnish
tts.type = formant-synthesis
```

Also, from the input section:

```
input.mic = yes
input.keyboard = yes
```

it can be seen that the MS 11 can receive inputs from the microphone 14 and from the keyboard 28.

With this voice UI profile, it is implicit that the MS 11 does not have the capability to accept inputs from any kind of input device which is not listed as being accepted. For example, the MS 11 does not in this embodiment have the capability to accept inputs provided by a mouse or by a stylus. The same applies to output devices, e.g. the output section following allows for speaker and display outputs but not for vibration outputs:

```
output.speaker = yes
output.display = yes
```

The following appears in the dialogue section:

```
5      dialogue.strategy = system_driven  
      dialogue.verification = explicit  
      dialogue.maximum_trials = 3  
      dialogue.maximum_timeout = 10
```

from which it can be determined that the MS 11 has system driven strategy
10 capabilities, that it is limited to explicit verification, with a maximum of 3 trials and
a timeout of 10 seconds. The timeout value relates to the time that the ASR will
wait for a user input before returning an error message to the user.

The voice UI profile is stored as a file in ASCII or in binary form, although it could
15 equally well be stored in a scripting language for VoiceXML, SALT, or in a style
sheet. Access to modify the voice UI profile by a user of the MS 11 is very limited,
is less limited to an operator of the system 10, and equipment manufacturers have
full modification access. Allowing access to the voice UI profile provides the
possibility for pre-defining what types of multimodal input/output features are to
20 be run on the MS.

The voice UI profile thus describes fully the voice UI capabilities of the MS 11. To
run an application having voice UI features on the MS 11, the voice UI profile is
examined to see which features are usable with the MS. This will now be described
25 further with reference to Figure 2.

Referring to Figure 2, an operation 30 begins in response to a user input at step 31
by downloading an application to be run on the MS 11 from the voice UI
application server 24. In this example, the voice UI profile storage device 27 is not
30 used, and the only purpose of the server 24 is to provide the application for
downloading over-the-air to the MS 11. The application may be any computer
program, such as a program for maintaining a diary system or a program for

allowing entry to a lottery or lotto. The CPU 13 stores the downloaded application in the application storage device 17.

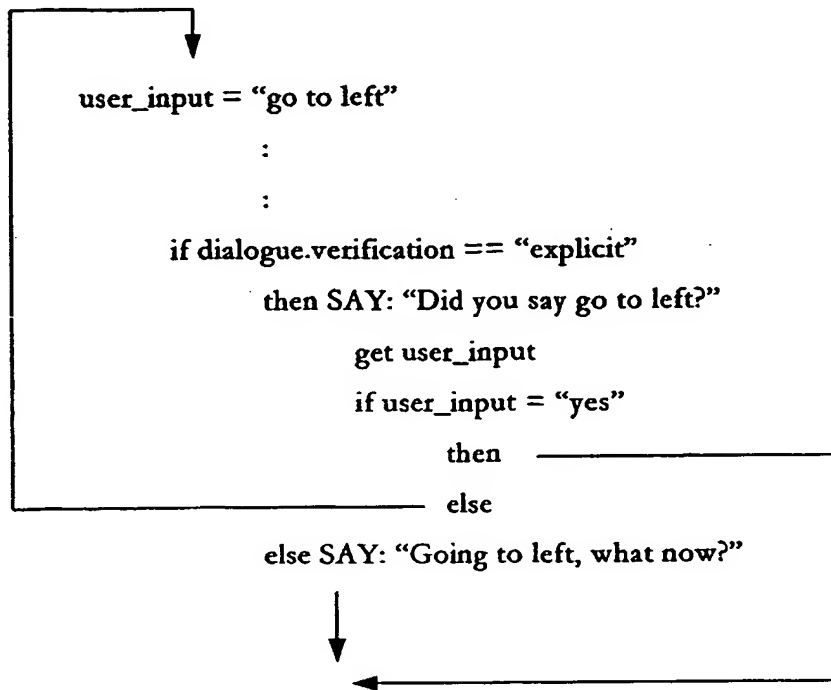
At step 32, a part of the voice UI profile is read from the voice UI profile storage device 18, this part including the information required for initialisation of the application. These parts may include device complexity, ASR languages supported, grammar and vocabulary information. Initialisation then occurs at step 33. If the application has been downloaded at an earlier time, then the downloading step 31 is omitted, as is the initialising step 32 if the application has already been initialised.

Step 34 then causes the operation 30 to remain frozen until it is determined that it is required to execute or run the application, at which time progress is made to step 35. Here, the application is executed by the CPU 13. During execution, the CPU 13 uses the application as initialised, and refers to the voice UI profile, by reading the profile from the storage device 18, when a determination needs to be made as to whether or not a feature is supported by the MS 11.

During execution, many of the instructions given by the application are executable without any voice UI capability information or are executable with the information provided during initialisation.

20

However, there are also instructions which require recourse to the voice UI profile. The following, given at algorithmic level rather than in any programming language, is an example of this:



As can be seen, certain instructions are decisions which require input from the voice UI profile. In the above illustration, the CPU 13 must determine whether the dialogue verification capabilities require explicit verification. Since the MS 11 does require explicit verification (see the dialogue section of the profile above), the CPU 13 uses TTS to ask a user "Did you say go to left?" and follows the instructions on the remainder of that sub-branch of the application. If this same application was run on an MS (not shown) which did not require explicit verification, then the sub-branch including the instruction to say "Did you say go to left?" would not be implemented. Instead, the instruction to say "Going to left, what now?" would be implemented, whereas this would not be the case with the MS 11.

Another example of a part of an application is given here:

```

15      if.tts.type == pre-recorded prompt
          SAY: welcome_prompt
      else
          SAY: "Hello, how can I help you?"
20

```

Thus, it will be seen that the first SAY instruction is run or used only if the TTS capabilities of a terminal on which the application is run are limited to pre-recorded prompts. In this case, the SAY instruction plays a pre-recorded voice (e.g. amr, wav, etc) file. The second SAY instruction is run only if the TTS capabilities are not so limited, i.e. full TTS capabilities are present. In this latter case, the text in the SAY instruction is provided to a TTS engine for synthesis.

It will be appreciated, therefore, that provision of the voice UI profile allows the CPU 13 to use only parts or features of the application which are appropriate to the voice UI capabilities of the MS 11, and to refrain from using parts or features of the application which are inappropriate. It will also be appreciated that the voice UI capabilities of the MS 11 are defined in the voice UI profile, so that using parts or features of an application which are appropriate to the profile is the same as using parts or features which are appropriate to the MS 11.

This allows application development to be a straightforward matter, especially since it is not necessary to design a different version of an application for each of the different possible combinations of voice UI capabilities. This also has significant advantages for the user of the MS 11 since no decision has to be made as to which version of the application to buy or download, and no signalling of the voice UI capabilities of the MS 11 is necessary before the downloading of an application from an application server.

Furthermore, a single application can run seamlessly on whatever form of MS a user might have, making the application more attractive to use. A user might transfer the application from one MS to another MS having different voice UI capabilities, and run or use the application on that other MS, which would not necessarily be possible if the application was designed specifically to function to the best ability of the first mentioned MS.

A diary application when run on an MS having natural language voice input capabilities might accept an instruction such as "contact Matti Nokialainen and inform him that our meeting will start an hour late at 2pm" and take the necessary

actions. Running the same diary application on an MS having only finite state grammar capabilities might result in the following dialogue:

MS: Please say e-mail, calendar or reschedule,
5 User: Reschedule,
MS: You have a meeting today with Matti Nokialainen at 1pm and with John Smith at 3pm, which meeting do you want to reschedule?
User: with Matti Nokialainen,
MS: And to what time?
10 User: 2pm,
MS: I will inform Matti Nokialainen that the meeting will start at 2pm,

As application having instructions for both of the above possibilities may require less development resources than would be required to develop two applications, one
15 for each possibility. Of course, the savings increase as the number of combinations of different voice UI capability features increases.

Some aspects of the functioning of the application on the MS 11 are defined by the voice UI profile and by the application together. An example of this is the
20 vocabulary supported by an application allowing entry into a lottery or lotto. Here, the application defines acceptable vocabulary using proper syntax to convey the following:

POLITE_EXPRESSIONS:

25	could you	BIG_TERMINAL
	please	
	would you	BIG_TERMINAL
	can I	BIG_TERMINAL
	is it	BIG_TERMINAL
30	possible	BIG_TERMINAL
	I want	
	

LOTTO:

	combination	BIG_TERMINAL
	one	
	two	
	three	
5	four	
	
	numbers	
	BYE:	
	good bye	BIG_TERMINAL
10	that's it	BIG_TERMINAL
	thanks	
	bye	
	exit	
	I want to finish	BIG_TERMINAL
15	Enough	BIG_TERMINAL
	

In running an application including the above vocabulary section, the CPU 13 examines the device complexity term in the general section of the voice UI profile to determine whether or not the MS 11 has big terminal capabilities, which in this example it does (see the general section above). Accordingly, all of the terms given in the vocabulary section are available for use by the application, and the CPU 13 works with the application to make all of the vocabulary available. If, on the other hand, the MS 11 did not have big terminal complexity, then the CPU 13 and the application would make available for use only the terms which are not specified to be big terminal terms.

A similar scheme is applied to the language model, or grammar. There are two main types of grammar, namely statistical grammar and context free (task) grammar. Statistical grammar is best suited to applications with large speech recognition vocabularies. It includes normalised frequencies of occurrences of word pairs (and occasionally word triples). The frequencies may be included in the application as in the following example:

	exit	thank you	0.018
		bye bye	0.021
		thanks goodbye	0.029
5		
	message	send message	0.03
		text message	0.028

From this it can be seen that the probability of two words in an 'exit' section of an application being 'thank' and 'you' in that order is 0.018. It will be obvious that use of statistical grammar can result in a large amount of information, since the number of pairs increases exponentially with the size of the vocabulary.

Task grammar is simpler in that it includes a compact notation of possible phrases. An example of how semantic labels (in bold) are returned by a task grammar follows:

```

<what>=
(send [a]) (message: message | SMS: message | (short |
text) message: message | email: email | mail: email |
20 electronic mail: email) |
([his] | [her]) (info: info | business card: info | information:
info | some info: info) |
exit: exit | [bye] bye: exit | [thanks] goodbye: exit |
thank you goodbye: exit |

```

25

Here, '|' denotes an exclusive or operation, '(' refers to a grouping, and '[' denotes an optional occurrence.

However, the performance of task grammar is not usually as good as that of statistical grammar, although it is considered suitable for use in many types of application. The use of statistical grammar is generally preferred where the MS on which the application is to be run has the necessary capabilities.

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The voice UI profile associated with the MS 11, as well as being stored in the MS, may be stored at a central location on the network, for example at a voice UI profile storage device (not shown) associated with the home BS of the MS.

5

In another embodiment shown in Figure 3, an application is stored on the application storage device 26 of the server 24 which is included at the BS 12, rather than at the MS 11.

10 Referring to Figure 3, an operation 40 commences at step 41, then at step 42 determines whether the voice UI profile for the MS 11, with which the application is to be associated, is stored in the voice UI profile storage 27. If a negative determination is made, the voice UI profile for the MS 11 is uploaded from the MS and then stored in the voice UI profile storage 27 at step 43, following which the
15 operation 40 proceeds to step 44. Otherwise, the operation proceeds to step 44 without carrying out step 43. A part of the voice UI profile required for initialisation is read at step 44, and the application is initialised at step 45. The operation 40 remains at step 46 until it is determined that execution of the application is required, when the execution of the application at the CPU 25 of the
20 voice UI application server occurs at step 47. As with the embodiment described above with reference to Figure 2, running the application includes using parts of the application which are appropriate to the voice UI profile, and thus to the MS 11, and refraining from using parts of the application which are inappropriate to the voice UI profile. Execution ends at step 48 once the application has finished
25 running, and the operation then ceases at step 49.

Certain advantages arise from running or executing an application at the voice UI application server 24 instead of the MS 11. In particular, processing constraints of the MS 11 are not present at the server 24, which may therefore use the most
30 advanced ASR available (the voice of the user of the MS 11 may be carried to the server over a voice channel). The voice UI profile is of particular interest when producing voice outputs to the user of the MS 11. For example, if the voice UI profile shows the MS 11 to have only pre-recorded prompt capabilities, the

instructions included in the application which use the prompts stored at the MS are used. Alternatively or in addition, instructions included in the application which cause the transmittal of voice signals, generated by a TTS function at the server 24, are used. These voice signals may be carried over a voice channel. If, however, the voice UI profile shows the MS 11 to have full TTS capabilities, then instructions of the application which cause the server 24 to send text signals to the MS, for synthesis thereof, are used over a VoIP channel. Alternatively, recognition is achieved using apparatus operating according to the distributed speech recognition principle.

As will be appreciated from the above, one application can be used on different MSs having numerous different voice UI capabilities. However, the fact that different capabilities need to be allowed for when developing an application introduces an increased number of possibilities of errors in a developed application. The emulator apparatus of Figure 4 constitutes a development aid.

Referring to Figure 4, the emulator 50 comprises a CPU 51, which is connected to each of a voice UI 52, a graphical user interface (GUI) 53, a voice UI profile storage device 54, an application storage device 55 and an emulator software storage device 56. Of course, the storage devices 55, 54 and 56 could form part of the same physical device, which could be RAM, EEPROM or magnetic storage for example. Operation of the emulator apparatus 50 in testing an application will now be described with reference to Figure 5.

Referring to Figure 5, the operation 60 begins at 61, following which the application is loaded into the application storage device 55 at step 62. The voice UI profile of a notional device against which the application is being tested is then loaded into the voice UI profile storage device 54 at step 63. The application is then initialised, at step 64, using part of the voice UI profile, as described with reference to Figures 1 and 2, before being run or executed at step 65.

The aim of running the application is to test its operability. At step 66, the dialogue is tested. To avoid errors in other parts of the application affecting dialogue testing, step 66 is carried out using text inputs, which are provided by the emulator software

stored in the emulator software storage device 56. Any response which differs to that expected is displayed using the GUI 53, along with an indication of the progress of the testing procedure. This allows the developer to check that the application responds properly to each possible input. When it is detected, at step 5 67, that the dialogue flow has been tested, the speech input and output features are tested at step 68. This step includes testing of the ASR aspects of the application including the vocabulary and grammar sections thereof and testing how the TTS module formulates system responses, and identifies what types of pre-recorded prompts are required. Once it is determined, at step 69, that the speech input and 10 output features have been tested fully, the operation 60 proceeds to step 70, where a test is carried out to check that the application meets required standards. If a negative determination is made, the operation returns to step 66, thereby introducing iteration. Only once a positive determination is made at step 70 does the operation proceed to end at step 71. The decision of step 70 may be made by a 15 human developer, or it may be automatic.

It will be appreciated that steps 66 and 68 involve the reading of voice UI capability information from the voice UI profile storage device 54, and that this information is used to run on the emulator apparatus 50 the parts of the application which are 20 appropriate to the profile, and to refrain from running those parts of the application that are inappropriate to the profile. This allows a developer to test an application against a target device, such as an MS having certain voice UI capabilities, with an indication given of any errors that might occur during the running of the application on the MS. Once the errors have been identified, the application can be modified 25 by the developer, and the modified application tested using the emulator apparatus 50 and the operation 60. This iterative process concludes only once the developer is content that the application complies with the pre-defined requirements.

Claims

1. A method of operating a mobile device, the method comprising:
maintaining a profile of voice user interface capabilities associated with the
5 device;
storing an application having voice user interface features on the device or
on a server in communication with the device;
examining at least part of the profile; and
using voice user interface features of the application which are appropriate
10 to the profile and refraining from using inappropriate features.
2. A method as claimed in claim 1, further comprising prior to the using step:
initialising the application using information included in the profile.
- 15 3. A method as claimed in either preceding claim, in which the maintaining step
includes maintaining information relating to any combination of vocabulary,
dialogue, automatic speech recognition and text-to-speech synthesis capabilities.
4. A method as claimed in any preceding claim, in which the maintaining step
20 includes maintaining information relating to grammar capabilities, for example
whether statistical or context free grammar capabilities are associated with the
device.
5. A method as claimed in claim in any preceding claim, in which the using step
25 includes referring to definitions forming part of the application, and using those
definitions with at least part of the profile to determine which parts of the
application are appropriate to the profile.
6. A mobile device, comprising:
30 a storage device for maintaining a profile of voice user interface capabilities
associated with the device;
a reader for examining at least part of the profile; and

an application runner arranged to run an application using voice user interface features of the application which are appropriate to the profile and to refrain from using inappropriate features.

5 7. A mobile device as claimed in claim 6, comprising an initialiser, arranged to use information included in the profile to initialise the application.

8. A mobile device as claimed in claim 6 or claim 7, in which the profile includes information relating to any combination or vocabulary, dialogue, automatic
10 speech recognition and text-to-speech synthesis capabilities.

9. A mobile device as claimed in any of claims 6 to 8, in which the profile includes information relating to grammar capabilities, for example whether statistical or context free grammar capabilities are associated with the device.
15

10. A mobile device as claimed in any of claims 6 to 9, in which the application runner is arranged to refer to definitions forming part of the application, and to compare these definitions with at least part of the profile to determine which parts of the application are appropriate to the profile.
20

11. A system comprising:
a mobile device having voice user interface capabilities; and
a server, capable of communicating with the mobile device,
the server being arranged to examine at least part of a profile voice user
25 interface capabilities associated with the mobile device, and to run an application using voice user interface features of the application which are appropriate to the profile and to refrain from using inappropriate features.

12. A system as claimed in claim 11, in which the server comprises an initialiser,
30 arranged to use information included in the profile to initialise the application.

13. A system as claimed in claim 11 or claim 12, in which the profile includes information relating to any combination of vocabulary, dialogue, automatic speech recognition and text-to-speech synthesis capabilities.

5 14. A system as claimed in any of claims 11 to 13, in which the profile includes information relating to grammar capabilities, for example whether statistical or context free grammar capabilities are associated with the device.

10 15. A system as claimed in any of claims 11 to 14, in which the server is arranged to refer to definitions forming part of the application, and to use these definitions with at least part of the profile to determine which parts of the application are appropriate to the profile.

15 16. A method of testing the compatibility of an application with a mobile device, the method comprising:

maintaining a profile of voice user interface capabilities associated with the device;

controlling an emulator to emulate the voice user interface features of the device using at least part of the profile; and

20 running the application on the emulator.

17. Apparatus for testing the compatibility of an application with a mobile device, the apparatus comprising:

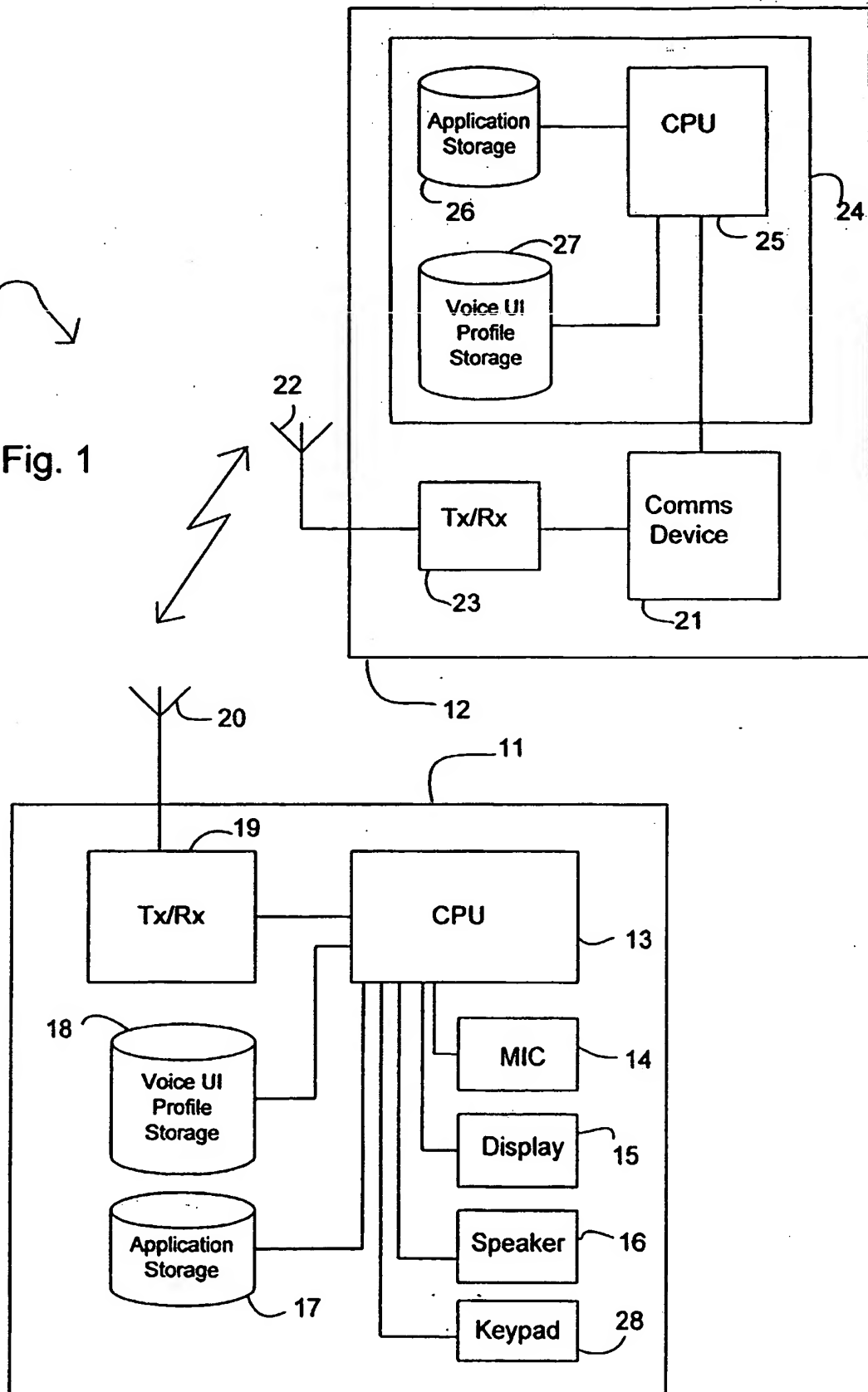
25 a reader for reading at least part of a profile of voice user interface capabilities associated with the device; and

an emulator for emulating the voice user interface features of the device using the at least part of the profile, and for running the application.

30 18. Apparatus as claimed in claim 17, in which the profile is stored on the apparatus.

10

Fig. 1



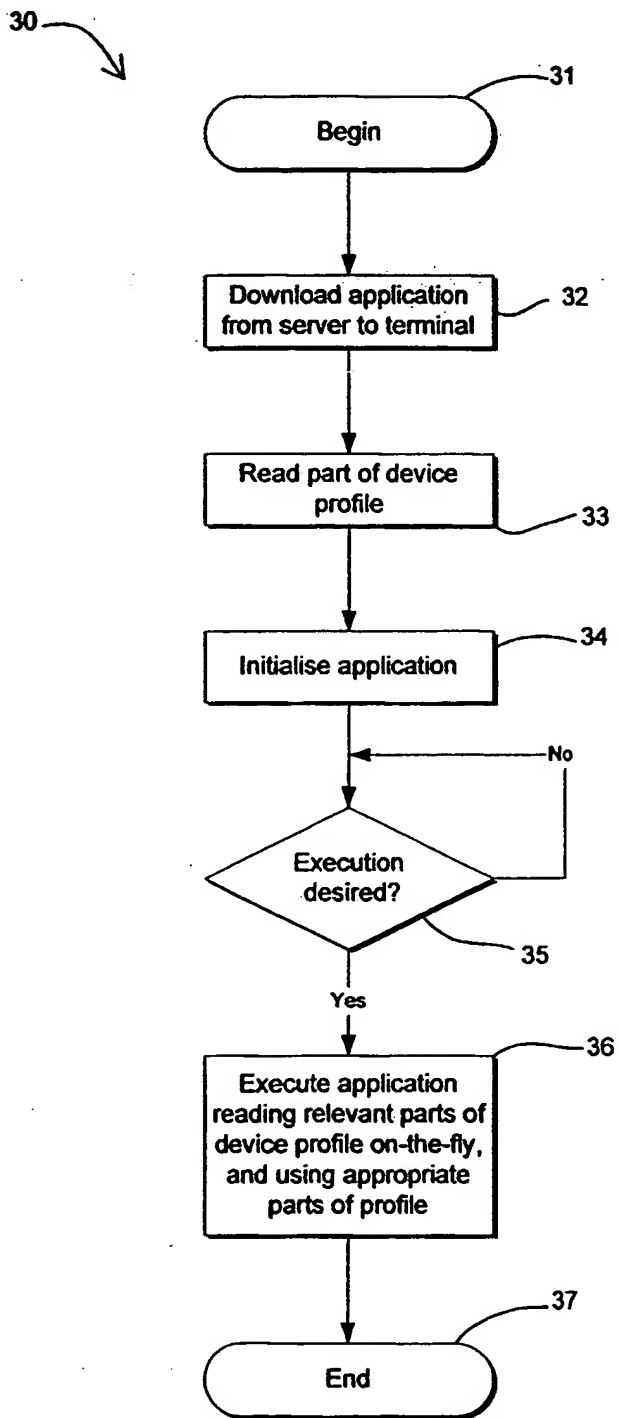
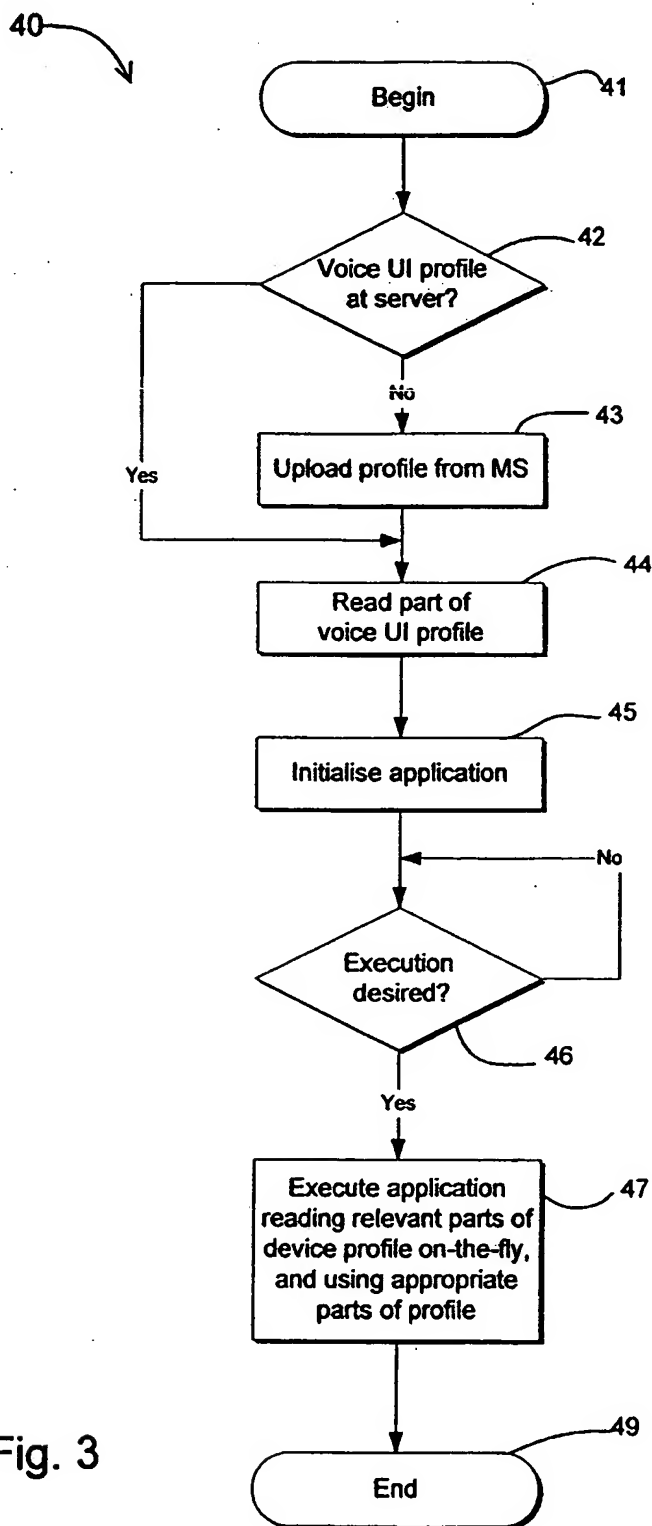


Fig. 2



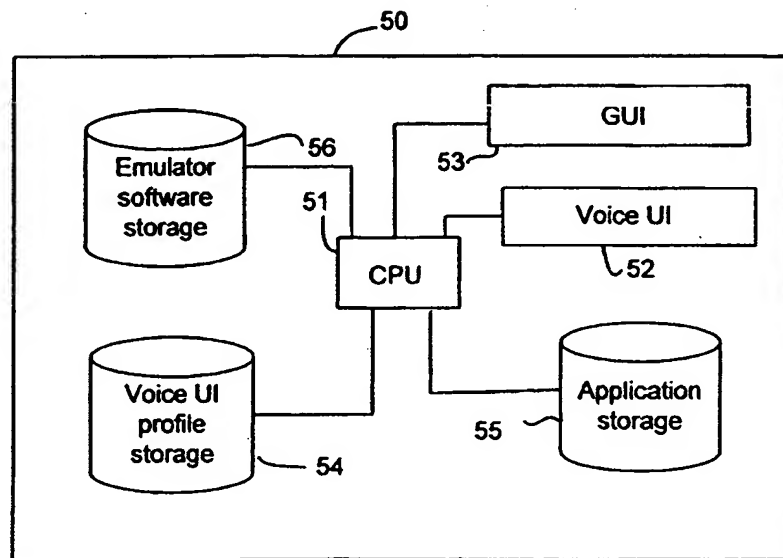


Fig. 4

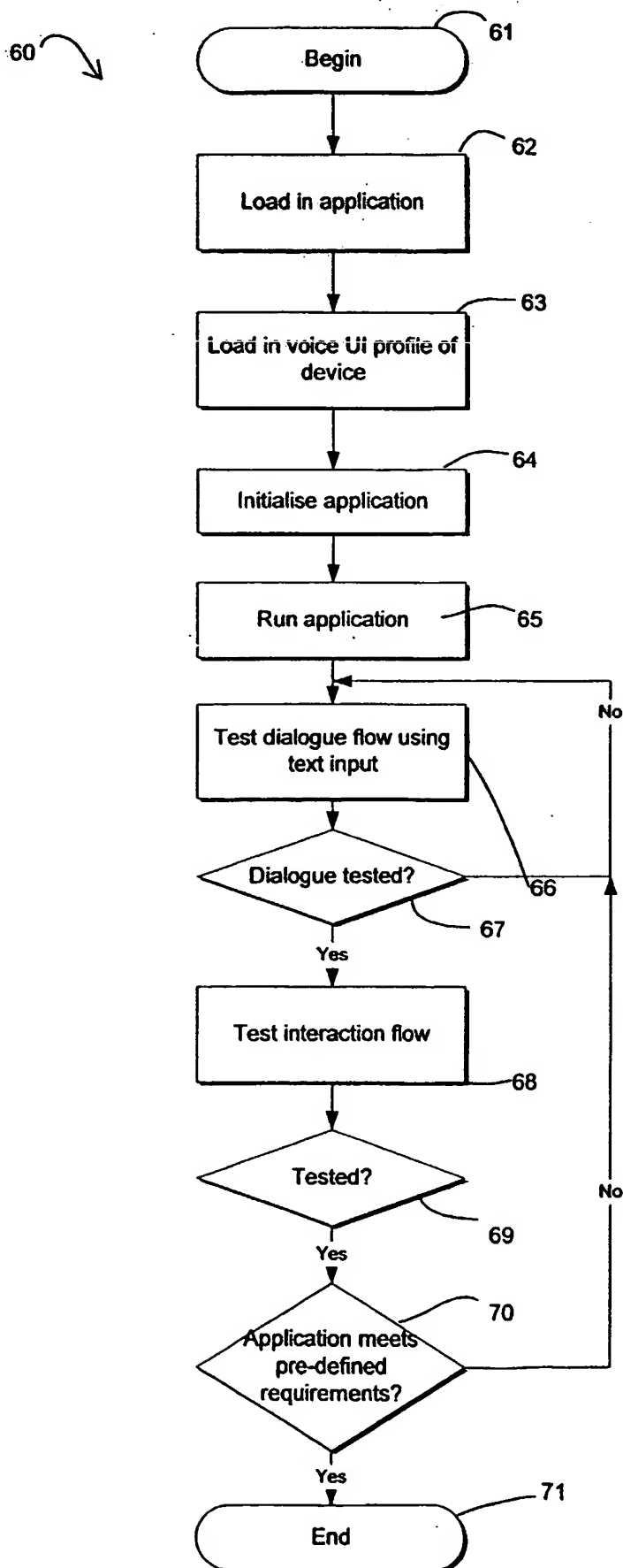


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 02/02848

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G01L 15/00, G06F 11/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G06F, H04B, H04Q, H04M, G10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1104155 A2 (PHONE.COM INC.), 30 May 2001 (30.05.01), column 3, line 30 - line 35; column 4, line 48 - line 55; column 6, line 18 - line 32, abstract, col.16 li.42,col.16 li.55 abstract	1-3,5-8, 10-13-15
Y	---	4,9,14
A	WO 0145086 A2 (NOKIA INC.), 21 June 2001 (21.06.01), page 3, line 1 - line 15; page 4, line 25 - page 5, line 12, abstract	1-3,5-8, 10-13,15
Y	page 10, line 32 - page 11, line 9 --	4,9,14

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents	T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	* document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 31 March 2003	Date of mailing of the international search report 03-04-2003
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Tomas Wassingbo /itw Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB 02/02848

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02054746 A1 (NOKIA CORPORATION), 11 July 2002 (11.07.02), page 3, line 11 - line 34; page 4, line 10 - line 16; page 6, line 18 - line 27, figure 1, claims 1-9, abstract --	1-15
A	WO 0195312 A1 (NOKIA MOBILE PHONES INC.), 13 December 2001 (13.12.01), page 5, line 16 - page 6, line 13; page 7, line 10 - line 25, figure 1, claim 1, abstract --	1-15
A	GB 2353918 A (TELEFONAKTIEBOLAGET LM ERICSSON), 7 March 2001 (07.03.01), page 2, line 9 - line 20; page 3, line 3 - line 5, abstract -----	16-18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 02/02848

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
EP	1104155	A2	30/05/01	CN	1298249 A	06/06/01
				JP	2001222294 A	17/08/01
WO	0145086	A2	21/06/01	AU	5440001 A	25/06/01
				US	6424945 B	23/07/02
WO	02054746	A1	11/07/02	US	2002097692 A	25/07/02
WO	0195312	A1	13/12/01	AU	5059101 A	17/12/01
GB	2353918	A	07/03/01	GB	9920703 D	00/00/00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 02/02848

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

There are two inventions in this international application, as follows:

Invention 1, claims 1-15; A method, mobile device, and system for maintaining a profile of voice user interface capabilities associated with the device.

Invention 2, claims 16-18; A method and apparatus for testing the compatibility of an application with a mobile device.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☒ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.